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Environmental Impact Assessment for the NASA Space Shuttle Orbiter Approach and Landing Test and Secondary Landing Site Facilities

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JOHN F. KENNEDY SPACE CENTER

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE
NASA SPACE SHUTTLE ORBITER
APPROACH AND LANDING TEST
AND
SECONDARY LANDING SITE
FACILITIES AT
FLIGHT RESEARCH CENTER, EDWARDS, CALIFORNIA

July 1975

FOREWORD

This report contains information pertaining to the environmental impact and the control of potential sources of environmental contamination which could result from proposed activities at the selected Approach and Landing Test (ALT) and Secondary Landing Site (SLS) Facility at the Flight Research Center, Edwards Air Force Base, California. Areas discussed include the environmental setting, institutional considerations, facilities and operations, environmental control, and compliance with local, state, and federal codes. An environmental assessment of this facility and its functions needed to support the Shuttle program is presented. This assessment indicates that the NASA Space Shuttle activities should not affect the environment significantly and that existing utilities will accomodate the Flight Research Center expansions. Planned activities are in compliance with the rules and regulations of the appropriate local, state, and federal pollution-control agencies. If this opinion continues, it is probable that the formal publication of this assessment as an environmental-impact statement is not required under the provisions of the National Environmental Policy Act of 1969.

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BRIEF PROFILE OF ACTIVITIES SCHEDULED FOR THE FLIGHT RESEARCH CENTER, EDWARDS AIR FORCE BASE

Approach and Landing Test (ALT) Program

The Approach and Landing Test (ALT) Program will be conducted at the Flight Research Center, Edwards, California. The primary objectives of the test program are:

1. Verify airworthiness of the Orbiter/Carrier Aircraft configuration for supporting Orbiter free-flight tests.

2. Verify an Orbiter manual approach and landing capability in the first Orbital Flight Test configuration.

3. Demonstrate an Orbiter AUTOTAEM/Autoland capability in the first Orbital Flight Test configuration.

4. Validate, in the minimum number of tests, an Orbiter capability to safely approach and land in the operational envelope of gross weight/center of gravity (GW/CG) configurations.

To accomplish these objectives, the Orbiter will be air-launched from the 747 aircraft for free flight to a lakebed or concrete runway landing. Prior to accomplishing the air-launch, a series of mated captive tests will be conducted to verify the capability to safely operate in the mated configuration and achieve the launch state.

Secondary Landing Site (SLS) Program

The first four Orbital mission landings are planned for Edwards Air Force Base. After these initial landings, Edwards becomes a Secondary Landing Site (SLS). A SLS is to be used as a weather alternate or a contingency landing field.

As a weather alternate, the weather conditions at KSC or VAFB (Vandenberg), depending on which primary site is being used, will be such that a safe landing is considered hazardous and the conditions are not expected to improve before the Orbiter systems or payload dictates a landing.

As a contingency landing field, Edwards Air Force Base would be used when it provides a safer landing site than the primary landing site.

Based on the above usages, it is reasonable to assume that Edwards Air Force Base would be used infrequently.

LOCATION AND DESCRIPTION OF THE FACILITY

The proposed facility will be located in the NASA Flight Research Center (FRC) at Edwards Air Force Base (EAFB), California. EAFB is situated in the Mojave desert, 60 air miles north of the Los Angeles metropolitan area. Under a land permit, FRC occupies 219 acres of the 300,000-acre EARB. Of the 219 acres, 25 acres are occupied by buildings, structures, and airfield pavements; 19 acres are surfaced for roads and parking lots and by other pavements.

NASA FRC was established approximately 25 years ago and has become the principal aeronautical flight research establishment in the United States. FRC conducts research and evaluates problems of manned flight, both within and above the atmosphere. It is a major facility for demonstrating and assessing advanced aerospace concepts. FRC missions include studies of takeoff and landing; low-speed, supersonic, and hypersonic flight; and flight vehicle reentry to verify predicted vehicle and flight characteristics and to identify unexpected problems in actual flight.

The FRC site is on the west side of Rogers Dry Lake; immediately south is the Air Force Flight Test Center. Rogers Dry Lake is one of many dry lakes in the desert which provide an almost unlimited selection of long unpaved runways for emergency or normal use in flight test and research programs. A flight test corridor extends from FRC northward through the desert area, and on many occasions the dry lake beds have been used to effect safe recovery of both research and operational test aircraft in the course of normal flight research activities as well as in emergency landings.

The relative isolation of FRC from populated areas precludes significant problems resulting from noise and sonic booms in the area. Moreover, the arid desert region provides excellent year-round flying weather, which contributes to the suitability of this location for the overall FRC mission. Finally, there is the proximity of the Air Force as well as the flight test facilities of aircraft manufacturers located at adjacent Edwards and neighboring Palmdale. This engenders a close relationship among Air Force, Navy, industry, and FRC activities.

The major research tool for conducting the programs and missions of FRC is its aircraft. They range from Century-series fighters to advanced supersonic/hypersonic aircraft and aerospace flight research vehicles, such as wingless lifting-body aircraft. A highly developed capability exists at FRC to instrument manned research and experimental aircraft for a broad spectrum of flight missions. There is a great variety of sensors and electronic data acquisition systems that can be used to equip aircraft for test missions ranging from low subsonic speeds to a Mach number of 7 and for altitudes from sea level to the edge of space.

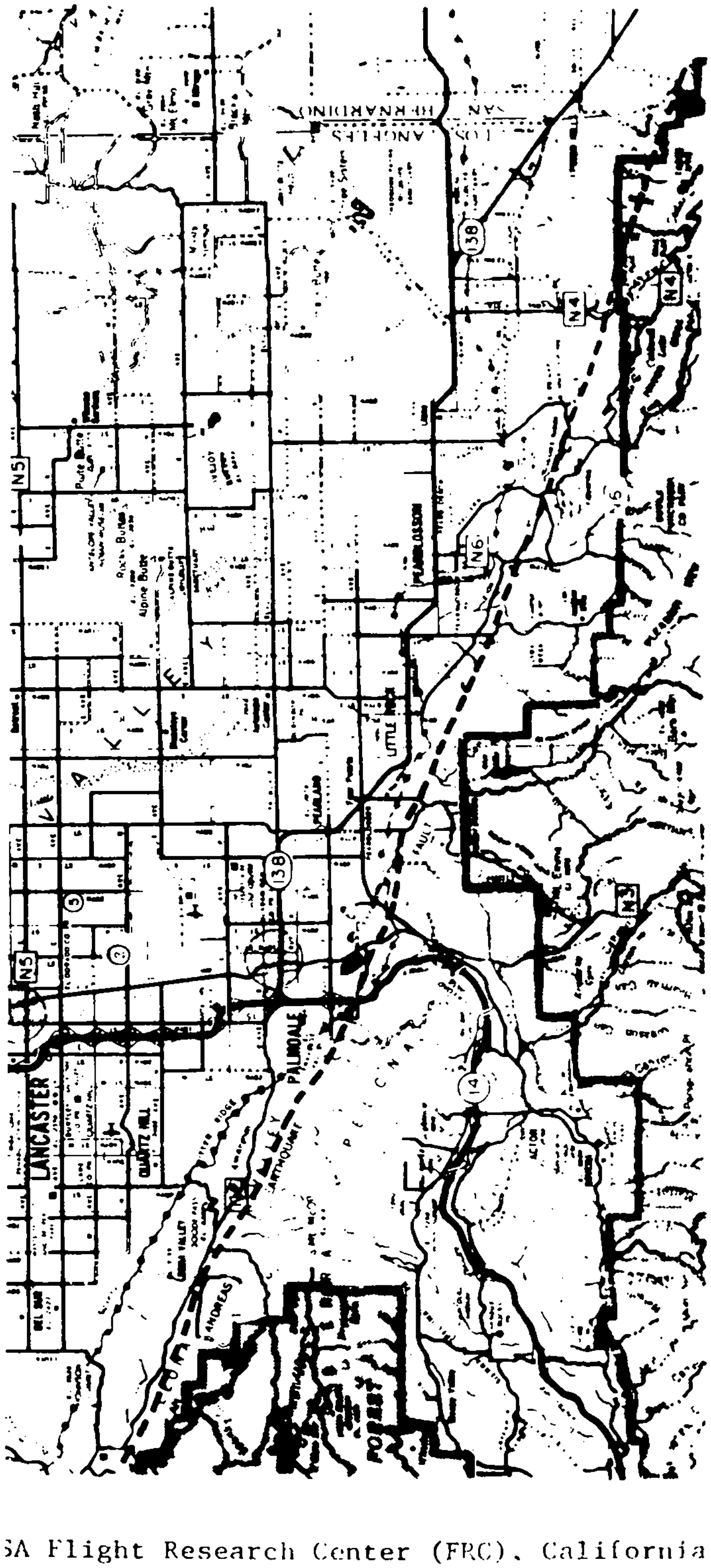
Ground-to-air communications for research and support aircraft are provided by long-range UHF equipment. Communications involving FRC, its support aircraft, and distant aircraft are maintained with single-sideband HF, UHF, and VHF equipment.

ENVIRONMENTAL SETTING FOR ALT AND SLS FACILITY

NASA FRC is located in the Antelope Valley portion of Kern County at the southernmost end of a vast and sparsely populated California-Nevada desert region. As shown in Figure 1, several towns and communities are located in the vicinity of FRC in what is known as the Antelope Valley; these include Lancaster, Palmdale, Mojave, Rosamond, and Boron. Lancaster is 30 miles southwest of FRC; Palmdale is 38 miles southwest; and Mojave is 22 miles northwest. Rosamond and Boron are 18 miles to the west and 20 miles to the northeast, respectively.

Topography

Topographically, the general region varies from the lowest elevation in the United States, 282 feet below sea level in Death Valley, to mountain peaks such as Mt. Whitney, in Sequoia National Park, 14,495 feet above sea level. Spanning this range are all types of intermediate physiography.



ЗA Flight Research Center (FRC), California

The area surrounding the site is largely undeveloped, rolling dry desert with mountain ranges in the distance. The FRC site (Figure 2) is roughly equivalent to a rectangle 4,000 feet (east-west) by 2,200 feet (north-south) with a triangular section extending 2,600 feet north of the eastern portion of the FRC facility. On the site, the ground slopes approximately 75 feet in the 4,000-foot length; the higher ground is at the west edge of the property and slopes down to the dry lake bed, the edge of the lake bed forming the eastern boundary of FRC. The dry lake bed is approximately 2,270 feet above sea level.

Climatology and Meteorology

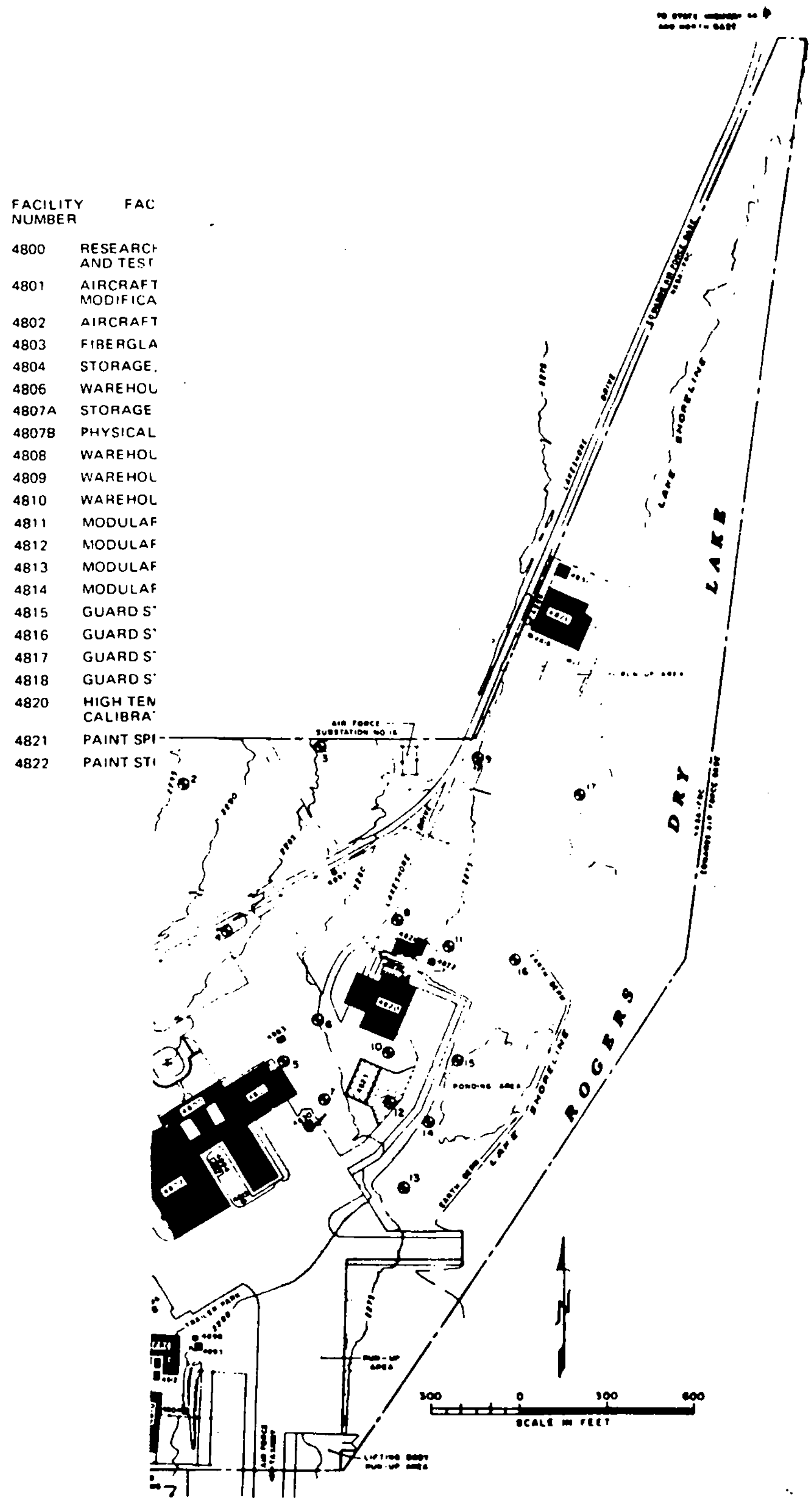
FRC lies within a region of arid climate, whose summers are characteristically hot: The mean daily maximum and minimum are 95°F and 63°F, respectively, and extremes are as high as 113°F. Winters are mild to cold with a mean minimum of 30°F in January and an extreme low of 3°F. The mean annual maximum and minimum temperatures are 76°F and 46°F, respectively. The mean relative humidity varies from 28 percent in July to 57 percent in December.

Precipitation is almost always in the form of rainfall, which averages 4.35 inches annually. Nearly all rainfall occurs from November to April during cyclonic storms, which are accompanied or followed by strong westerly winds.

Prevailing surface winds are from the southwest (seven months of the year), the west-southwest (four months), and the west (one month). Mean wind speeds vary from 6 knots in the winter months to 12 knots in May and June, with a mean annual speed of 9 knots.

Visibility is ten miles or more 95.9 percent of the time; 2 percent of the time, visibility is less than seven miles. Sky conditions are excellent, providing ceilings of 10,000 feet or more 94.6 percent of the time.

These climatological characteristics and others pertaining to the FRC region are summarized in Figure 3.



Site Plan, NASA FRC, California

		WINTER					SUMMER							
		NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	ANNUAL
TEMPERATURE	MEAN TEMP (°F)	52	44	44	48	52	58	66	74	82	80	74	62	61
	MEAN DAILY MAX (°F)	67	57	57	61	65	73	80	89	99	97	92	79	76
	MEAN DAILY MIN (°F)	36	30	30	34	38	44	51	58	66	64	57	46	46
	EXTREME MAX (°F)	85	84	82	80	87	97	105	112	113	112	109	99	113
	EXTREME MIN (°F)	13	7	3	14	17	27	32	40	51	47	34	19	3
	MEAN DAYS 100°F	0	0	0	0	0	0	.3	5	15	12	4	0	36
	MEAN DAYS 32°F	10	21	20	12	6	1	0	0	0	0	0	1	71
	MEAN REL HUMIDITY (%)	51	57	53	50	46	45	39	35	28	30	34	37	42
PRECIPITATION	MEAN PRECIP (INCHES)	.63	.71	.66	.74	.45	.26	.04	.02	.04	.1	.14	.15	3.94
	MEAN DAYS W/PRECIP	1.1	1.3	2.4	1.2	1.3	.9	.02	0	0	.2	.2	.6	9.4
	MEAN SNOWFALL (INCHES)	.2	.2	.6	T	.1	0	0	0	0	0	0	0	1.1
	MEAN DAYS W/TSTMS	.1	0	.1	.1	.2	.2	.1	0	1.1	1.4	1.1	.2	4.6
	EXTREME MAX PRECIP	3.35	3.7	3.16	4.4	2.32	1.49	.25	.26	.4	1.01	1.11	1.65	9.04
SURFACE WIND	PREVAILING DIRECTION (°)	240	250	250	260	250	250	240	240	240	240	240	240	250
	MEAN SPEED (KNOTS)	6	6	6	7	10	11	12	12	11	9	8	7	9
	EXTREME SPEED (KNOTS)	55	58	59	67	64	55	56	53	47	60	47	49	67
CEILING/ VISIBILITY	5,000 FEET - 5 MILES (%)	3.6	5.4	8.5	5.4	5.2	4.1	1.3	.4	.2	.1	.4	1.3	3
	1,500 FEET - 3 MILES (%)	1	1	1	1	1	.5	.5	.5	.5	.5	.5	.5	.5
	200 FEET - 1/2 MILE (%)	.5	.5	.5	.5	.5	.5	.5	0	0	.5	.5	.5	.5

Figure 3. Climatology Summary for Period of Record

Biota

The flora and fauna in the vicinity of the FRC site are typical of desert communities on well drained alluvial soils below an elevation of 5,000 feet. The following botanical, mammal, ornithological, and reptilian species are common to the arid/semi-arid region surrounding Edwards Air Force Base. No member of the identified western endangered species listing is found in this region.

Botanical

Buckthorn (Ceanothus spp.)
Sage (Salvia spp.)
Creosote Bush (Larrea tridentata)
Joshua Tree (Yucca brevifolia)

Mammals

Deer Mouse (Peromyscus maniculatus gambelii)
Desert Wood Rat (Neotoma lepida intermedia)
Merriam Chipmunk (Eutamias merriami)
Black-tailed Jackrabbit (Lepus californicus)
Coyote (canis latrans ochropus)
California Grey Fox (Urocyon cinereoargenteus californicus)
Wildcat or Bobcat (Lynx rufus californicus)

Birds

White-crowned sparrows (Zonotrichia leucophrys)
Scrub jay (Aphelecoma coerulescens)
California thrasher (Toxostoma redivivum)
Mourning Dove (Zendaidura macroura)
California Quail (Lophortyx californicus)
Red-shouldered hawk (Buteo lineatus)
Turkey vulture (Cathartes aura)

Reptiles

Coachwhip (Masticophis flagellum)
Coast horned lizard (Phrynosoma coronatum)
Western rattlesnake (Crotalus viridis)
Gopher snake (Pituophis melanoleucus)
Desert tortoise (Testudinidae, spp.)

Geology

The site is underlain by quartz monzonite of Jurassic to Cretaceous age. Over this lies a thin cover of alluvial sand and gravel of Recent age. At the west edge of FRC, the alluvium is overlain by a wave-deposited bar approximately 600 feet wide. This bar, which runs north-south, is composed mainly of interbedded coarse sand and pebble gravel with clay balls. The base, or east edge of the bar, lies along the 2,300-foot surface contour and is located on the edge of Rogers Dry Lake. The material in the dry lake consists of a playa clay, which is the fine playa or mud-flat facies of the Recent alluvium. The quartz monzonite disintegrates into small fragments or residual sand; therefore, the topography in this area is of low relief.

Seismology

No faults are mapped in the immediate vicinity of FRC. The nearest active fault zone is located more than 20 miles to the northwest and is known as the Garlock Fault; the San Andreas Fault is 30 miles to the southwest. These are the only potential sources of strong earthquake motion in the FRC area.

Records of earthquake epicenters for the general area indicate that fewer than ten earthquake-related events have occurred within 20 miles of FRC since 1934; these events all have magnitudes of less than 4 on the Richter scale. Earthquake intensities of VI to VII on the Modified Mercalli scale have occurred in this area fewer than ten times since 1810. A microregionalization map of Southern California shows that a shock with a maximum intensity of VII on the Modified Mercalli scale is possible within a 100-year period in the general area of the FRC. As there is no evidence of faulting in the immediate vicinity of FRC, the probability of surface rupture from earthquake activity is remote. Ground-shaking intensity depends on the distance from the earthquake source (fault): the greater the distance, the less the intensity but the longer the duration. However, soil conditions can also influence the intensity.

Soil conditions are favorable at this site, as the surface material is primarily sand. The bedrock (quartz monzonite) is close to the surface (two to seven feet), which is also favorable for building since earthquake-induced shock waves would travel through this bedrock so quickly that they would not have an opportunity to set up severe shaking in the thin soil cover. It is estimated that a peak ground acceleration of about 0.35 g's would result at FRC from an earthquake of large magnitude (7.5 to 8) centered along the San Andreas or Garlock faults.

Soils and Drainage

Soils

Eighteen exploratory borings to depths of 10 to 20 feet on the proposed site encountered two to seven feet of natural overburden soils of silty sand underlain by granite to the depths explored. Existing compacted fill soils (three to five feet thick) were firm. The natural overburden silty sand was also firm at the existing moisture content but would become weaker and more compressible when wet. The underlying granite is firm to very firm and hard.

Ground water was not encountered within the 20-foot maximum depth of exploration. Although the boring walls did not cave in during drilling and casing or drilling mud was unnecessary to advance the borings to the desired depth, a gad (chopping tool) was used to advance several of the borings; and two of the borings were terminated because of the hardness of the granite.

Foundations on the granite will provide excellent support with minimum settlement. Although conventional spread footings in deep excavations could be used, drilled-and-belled caissons should be the most economical method of reaching the firm granite.

Drainage

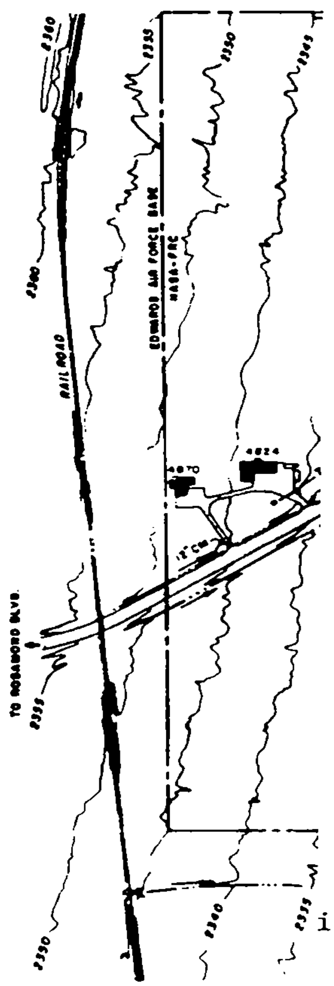
The natural drainage in the site area is generally from the west to the east. The storm drainage system in the developed area of NASA FRC consists of structures, as shown in Figure 4.

The northwest and west portions of the FRC are protected by an open drainage ditch, which runs along Lilly Avenue. From the intersection of Lilly Avenue and Forbes Avenue, the open ditch carries this flow south along Forbes Avenue. The flow is then conducted via an 18-inch underground corrugated metal pipe into a retention basin adjacent to the trailer park. Waste water from the aircraft wash rack located north of the trailer park also flows into the retention basin via a concrete drainage swale. Accumulated runoff in the retention basin flows east underground into Rogers Dry Lake through three 36-inch reinforced concrete pipes. The retention basin also collects surface runoff from the south.

Storm drainage from the north and east of the Research, Development, and Test Facility (4800) is conducted to a manhole near the east corner of the building. This manhole also receives

EXISTING FACILITIES

FACILITY NUMBER	FACILITY NAME	FACILITY NUMBER	FACILITY NAME
100	RESEARCH & DEVELOPMENT AND TEST FACILITY	4824	COMMUNICATIONS BUILDING
101	AIRCRAFT CONSTRUCTION & MODIFICATION HANGAR	4824A	SEPTIC TANK & DRAIN FIELD
102	AIRCRAFT HANGAR	4826	AIRCRAFT MAINTENANCE DOCK
103	FIBERGLASS SPRAY BOOTH	4830	APU CONTROL BUILDING
104	STORAGE, PAINT & OIL	4831	WAREHOUSE # 5
106	WAREHOUSE # 1	4870	MPS RADAR BUILDING
107A	STORAGE BUILDING	4870A	SEPTIC TANK & DRAIN FIELD
107B	PHYSICAL STRESS LAB	4882	3900 GAL WATER STORAGE TANK
108	WAREHOUSE # 2	4883	ELECTRIC SUBSTATION # 10
109	WAREHOUSE # 3	4884	ELECTRIC SUBSTATION # 11
110	WAREHOUSE # 4	4886	STEAM PLANT
111	MODULAR STRUCTURE	4887	BORESIGHT TOWER
112	MODULAR STRUCTURE	4888	ELECTRIC SUBSTATION # 4
113	MODULAR STRUCTURE	4889	CENTRAL STANDBY ELECTRIC GENERATOR SYSTEM
114	MODULAR STRUCTURE	4891	FILLING STATION, GASOLINE
115	GUARD STATION # 1	4892	ELECTRIC SUBSTATION # 3
116	GUARD STATION # 3	4893	ELECTRIC SUBSTATION # 2
117	GUARD STATION # 2	4894	ELECTRIC SUBSTATION # 1
118	GUARD STATION # 4	4895	UTILITY TUNNEL
120	HIGH TEMPERATURE LOADS CALIBRATION LABORATORY	4896	EJECTOR STATION, SEWAGE
121	PAINT SPRAY BUILDING	4897	EJECTOR STATION, SEWAGE
122	PAINT STORAGE BUILDING	4898	AIRCRAFT FUEL DISPENSER
		4899	5000 GAL WATER STORAGE TANK
		FRC	TRAILER PARK



LEGEND

EXISTING NASA PROPERTY LINE
CONTOUR (INTERVAL 5 FEET)
EXISTING FENCE
TRAIL
EXISTING PAVEMENTS
EXISTING FACILITIES
STORM DRAIN LINE WITH SIZE & MATERIAL
PAVED INVERT DRAIN
DRAINAGE DITCH
FLOW
HEADWALL
MANHOLE
CATCH BASIN
CLEANOUT

ABBREVIATIONS

CI	CAST IRON
CM	CORRUGATED METAL
RC	REINFORCED CONCRETE
VC	VITRIFIED CLAY

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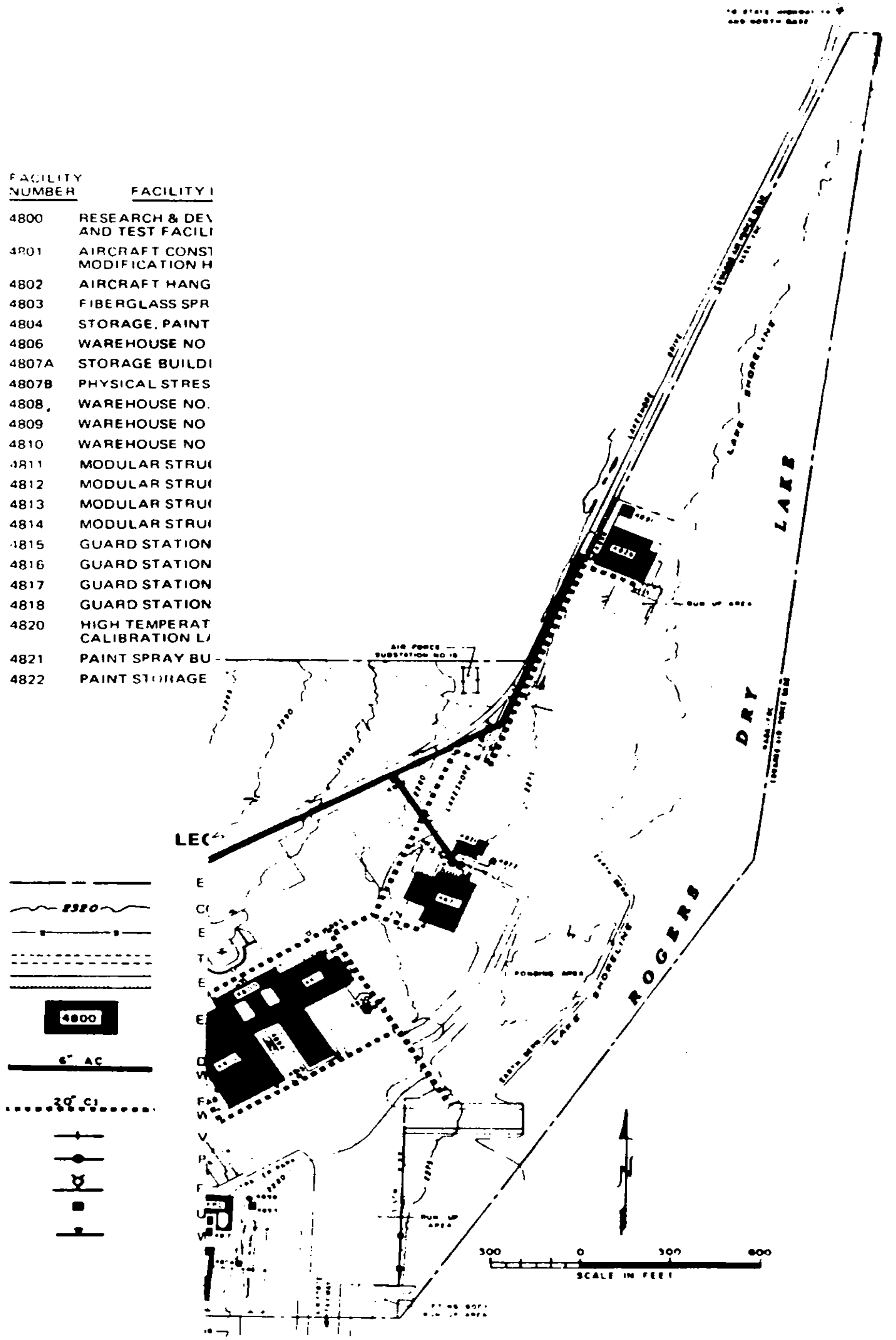


n, NASA FRC, California

drainage flow from roof and floor drains, refrigeration unit wastes, and auxiliary unit water from Facilities 4800, 4801, and 4802. The flow from the manhole is conducted east in an underground 30-inch reinforced concrete pipe to the ponding area adjacent to Rogers Dry Lake. The ponding area, which is approximately 300 feet by 1200 feet, has a low earth berm with overflow sluice gates on the east side that open onto the dry lake. Should the ponding area become saturated or stagnant, an auxiliary rain-bird sprinkler system would be installed to spray the collected water into the atmosphere above the pond to expedite evaporation.

Surface runoff from the airfield pavement area at the rear of Facilities 4801 and 4802 flows east into catch basins at the edge of the pavement and then through corrugated metal pipes into the ponding area.

Water Supply and Treatment

EAFB is served by a private sewage collection system and a central treatment plant, which was designed to accommodate all facilities located there. (See Figure 5.)

The source of all water used at the base is underground from Air Force wells. This water is of good quality, with a total dissolved solids content of 520 parts per million. This water is distributed with no treatment except for chlorination. Domestic water is supplied to NASA-FRC owned tanks located approximately 5,700 feet southwest of the FRC facilities. Distribution to the FRC facilities is made from these tanks.

The FRC fire protection system is dependent on the Edwards Air Force Base domestic water system. It is fed by a 20-inch main from two elevated storage tanks (500,000 and 300,000 gallons) located approximately 5,700 feet southwest of the steam plant (4886). The storage tanks are approximately 170 feet higher than the steam plant.

Sewage Flow and Treatment

The NASA FRC sewage collection system comprises laterals and trunks that flow into two sewage ejector stations (4896 and 4897), as shown in Figure 6.

Sewage from the High Temperature Loads Calibration Laboratory (4820) and the aircraft maintenance dock (4826) flows into Sewage Ejector Station 4897. From this station, sewage is pumped southwest 2,000 feet through an outfall consisting of a 6-inch cast-iron (CI) force main. From there, the sewage flows by gravity in an 8-inch vitrified clay pipe (VCP) one-fourth of a mile south to an Air Force manhole and outfall.

Sewage from the remainder of the NASA FRC complex flows through laterals and trunks to Sewage Ejector Station 4896. The sewage collected at this station is pumped through a 6-inch CI main southwest approximately 1,500 feet to the aforementioned manhole and outfall.

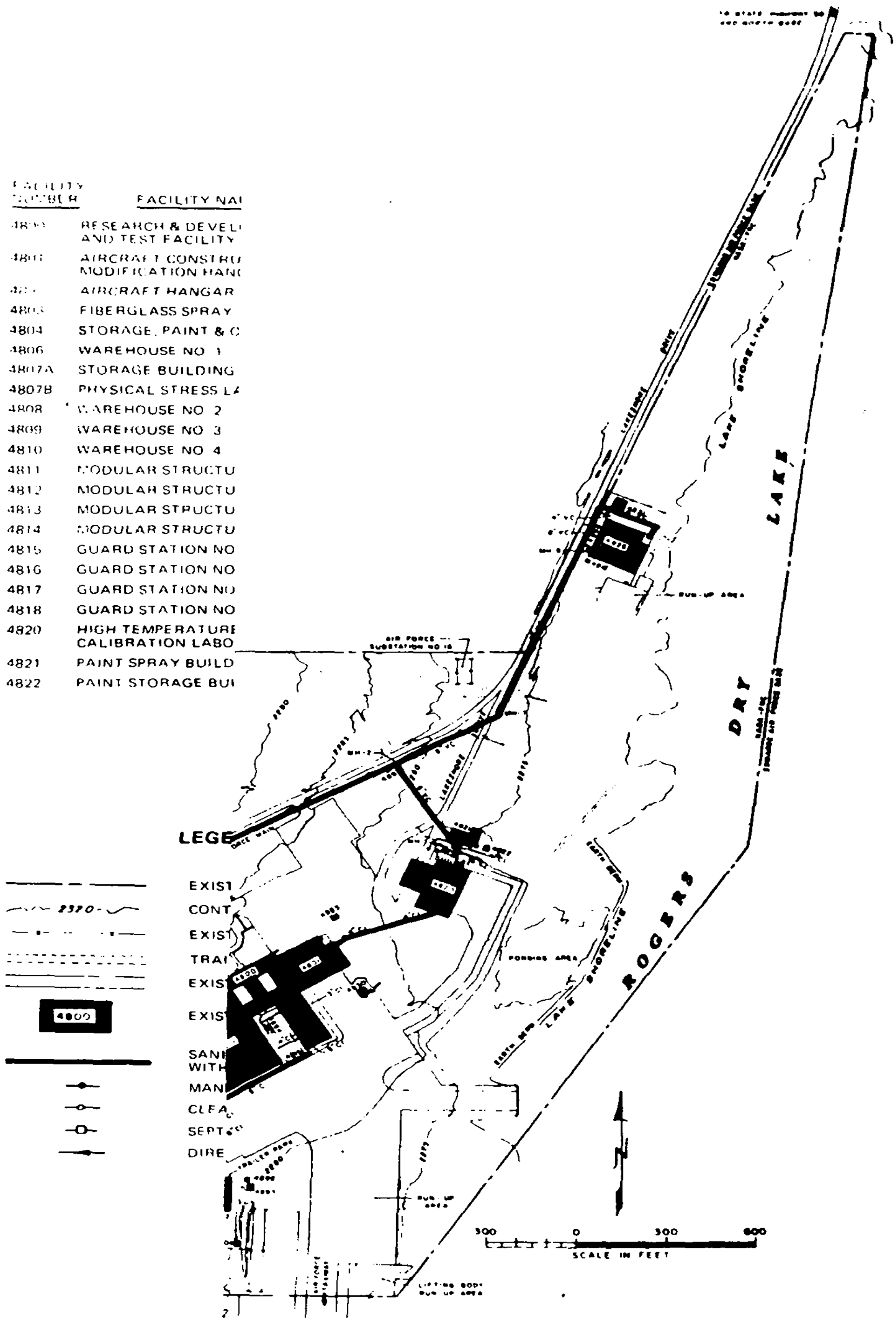
Both sewage ejector stations are of the duplex pneumatic-ejector type, each capable of pumping 150 gallons per minute. Sewage Ejector Station 4897 was designed to accommodate the sewage flow from the High Temperature Loads Calibration Laboratory, from the aircraft maintenance dock, and from authorized and projected construction.

The sewage is subjected to primary and secondary treatment at the central Air Force sewage treatment installation. The sludge from the primary settling tank goes to the digester. The digested sludge is spread for drying and disposed of in the sanitary land fill. The sewage from the primary tank flows into prepared oxidation and evaporation ponds, where secondary treatment takes place. The soil in the ponding area permits very little seepage.

The capacity of the sewage treatment facility is approximately 1,500,000 gallons per day, and the combined EAFB-NASA FRC average daily flow of 1,000,000 gallons is well within the capacity.

The sewage from the Communications Building (4824) and the MPS Radar Building (4870) flows into individual septic tanks and tile drains at each building location. However, arrangements are being made to extend the sanitary sewerage system so that by 1976 this sewage will also flow into the central sewage treatment plant.

FACILITY NUMBER	FACILITY NA
48??	RESEARCH & DEVEL AND TEST FACILITY
48??	AIRCRAFT CONSTRU MODIFICATION HAN
48??	AIRCRAFT HANGAR
4803	FIBERGLASS SPRAY
4804	STORAGE, PAINT & C
4806	WAREHOUSE NO 1
4807A	STORAGE BUILDING
4807B	PHYSICAL STRESS LA
4808	WAREHOUSE NO 2
4809	WAREHOUSE NO 3
4810	WAREHOUSE NO 4
4811	MODULAR STRUCTU
4812	MODULAR STRUCTU
4813	MODULAR STRUCTU
4814	MODULAR STRUCTU
4815	GUARD STATION NO
4816	GUARD STATION NO
4817	GUARD STATION NO
4818	GUARD STATION NO
4820	HIGH TEMPERATURE CALIBRATION LABO
4821	PAINT SPRAY BUILD
4822	PAINT STORAGE BU



ers, NASA FRC, California

Other Utilities

Other important utilities are natural gas, electricity, and telephone service.

Gas

Natural gas is supplied to NASA FRC by the Pacific Gas and Electric Company (PG&E) through a 6-inch high-pressure line located approximately 1,200 feet northwest of the northwest corner of the FRC property line. PG&E meters gas to FRC at this location at 20 psig. Natural gas is fed into a 4-inch line that extends southeast to the FRC complex.

At present, there is an ample supply of gas, which is being supplied on an uninterruptible basis until 1980. No shortage of natural gas is foreseen at NASA FRC.

Electricity

Electrical energy is supplied to EAFB by the Southern California Edison Company (SCE) at 115 kilovolts to SCE/EAFB Switching Station No. 1, which has a capacity of 50 megawatts. This switching station is located at the north boundary of EAFB immediately west of Rosamond Boulevard near State Highway 58. Primary distribution to FRC is at 12 kilovolts by two 34.5-kilovolt feeders to EAFB Substations 2 and 16. At present, there is ample electricity; however, brownouts may be a possibility in the future.

Telephone

Pacific Telephone and Telegraph provides the primary telephone service to NASA FRC with a 450-pair cable from the EAFB telephone center. EAFB serves FRC with ten trunk lines, five of which can be used for incoming calls; all ten can be used for outgoing calls. Telephone service is extended to other FRC facilities and locations from the FRC switchboard in underground conduits or concrete-encased ducts.

Acoustics

The only significant noise presently experienced in the area of the proposed hangar building is that generated during aircraft engine run-up for maintenance, trim runs, and other tests and operations. Existing aircraft run-up areas at EAFB are shown in Figure 7. The highest noise levels on the proposed site are producted by the F-111 in the NASA run-up area; these sound-level contours are shown in Figure 8. Advanced aircraft sound levels generated in the neighboring EAFB run-up area also result in approximately the same sound levels in this area. The sound-pressure levels presently produced in the proposed site are in the neighborhood of 100 dBA (A-weighted decibels).

Land Use

NASA FRC is located about three miles within the 485-square mile EAFB and adjacent to the 44-square-mile, sun-hardened, wind-smoothed bed of Rogers Dry Lake, which connects with the 27-square-mile Rosamond Dry Lake through Buckhorn Dry Lake.

Apart from the dry lakes, EAFB consists mostly of arid desert land. Its buildings, runways, roads, and other pavements occupy much less than one percent of the total area. Of the 219 acres occupied by NASA FRC, 44 acres are covered by buildings and structures, airfield pavements, streets, automobile parking areas, and other pavements. The remainder is open space.

The land use is primarily for Air Force and NASA FRC operations. Some housing is provided for Air Force personnel. Apart from these uses, the total area consists of open space. There is no agricultural usage.

Transportation and Traffic

Railroads

The Southern Pacific Railroad right-of-way

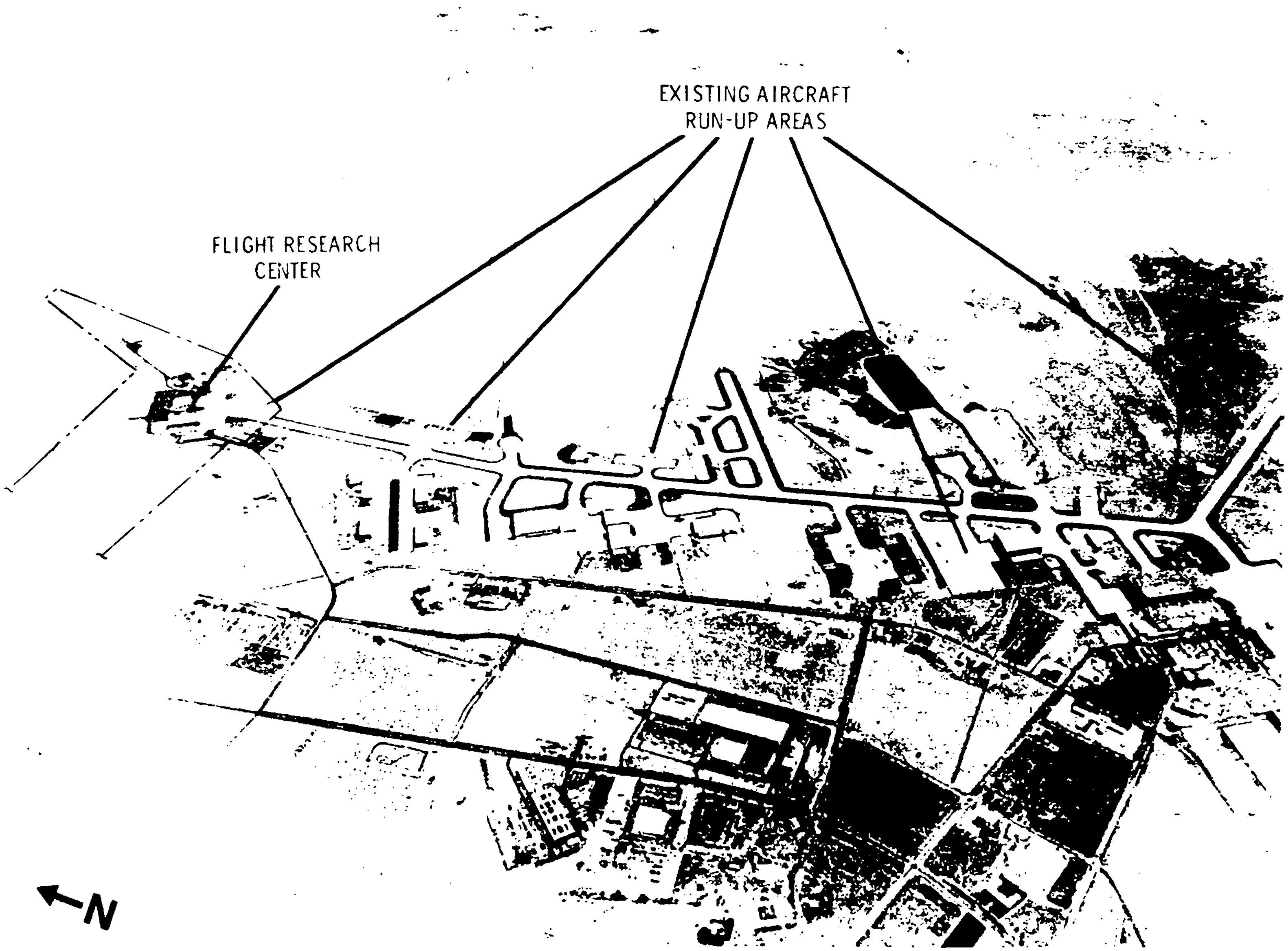


Figure 7. Existing Aircraft Run-Up Areas at EAFB

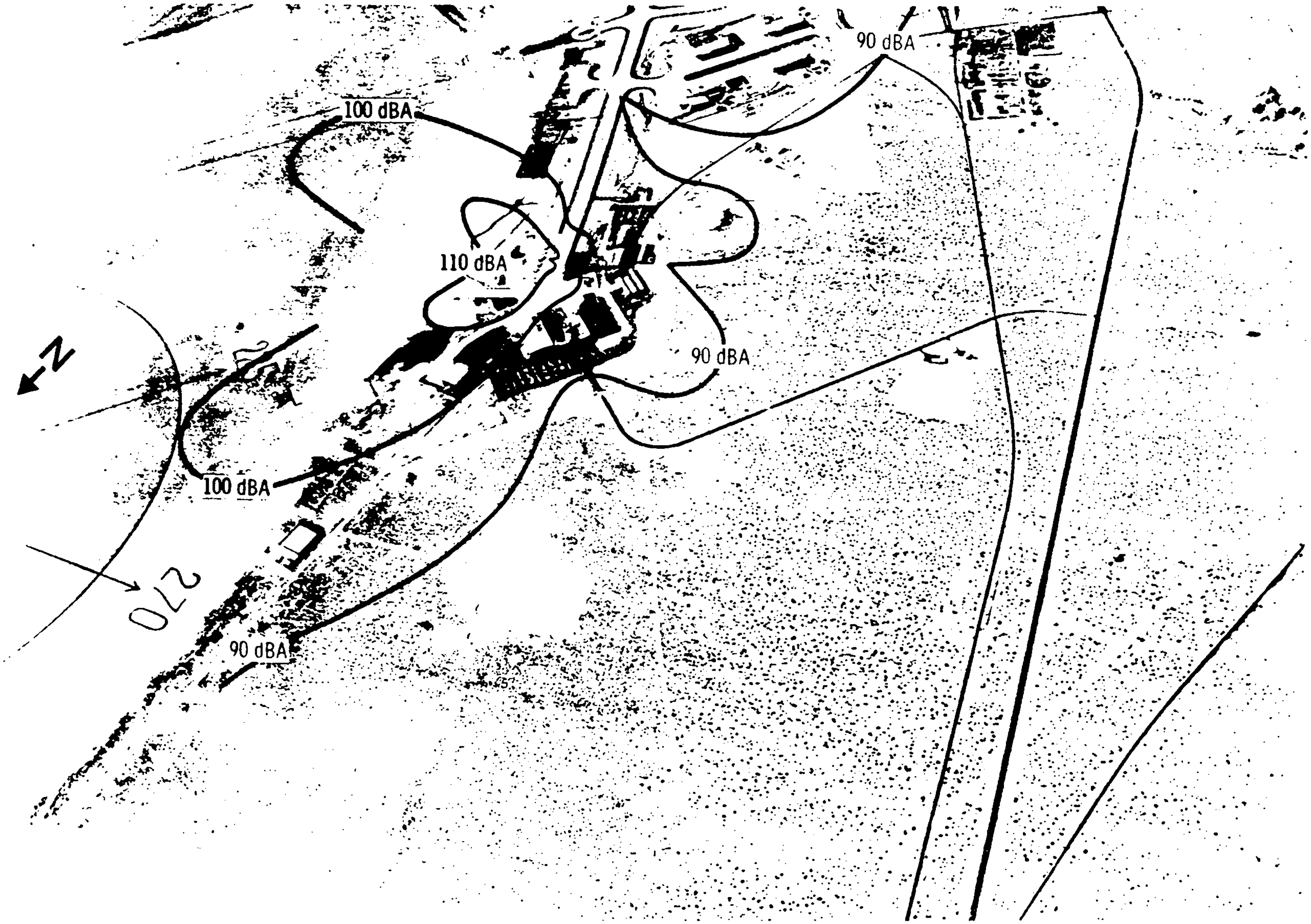


Figure 8. F-111 Sound-Level Contours From Presently Used NASA Run Up Area

runs north-south immediately west of the EAFB western boundary. An interchange with the Santa Fe Railroad is provided at Mojave. An Atchison, Topeka, and Santa Fe Railroad east-west line runs along the northern boundary of EAFB, with a spur line running south, parallel to the western boundary of FRC. Loading and unloading facilities with sidings are located a short distance south of FRC.

Highways

The existing freeway network, shown in the vicinity map (Figure 1), makes EAFB accessible from all directions. The predominant north-south arteries are the Sierra Highway and the Antelope Freeway (State Highway 14) near the west boundary of EAFB and U.S. Highway 395 on the east boundary. State Highway 58, which runs along the northern boundary of EAFB, is connected on the west with Interstate Highway 5 at Bakersfield and on the east with Interstate Highway 15 at Barstow.

The Greyhound bus line provides daily service to communities in the Antelope Valley. The Antelope Valley Bus Company provides local and commuter service to EAFB and to the Los Angeles International Airport.

NASA FRC personnel number approximately 750, which includes employees of NASA, support services contractors, and technical program groups consisting of contractors and other federal agencies. Approximately 23 percent of the personnel travel to and from FRC by bus; the remainder travel by private automobile.

The majority of the personnel reside in the Lancaster-Palmdale area and travel to FRC via the Antelope Freeway north to Rosamond and then east on four-lane Rosamond Boulevard to FRC. Employees living north of FRC (e.g., in Boron, California City, or Mojave) travel on State Highway 58 and then south on two-lane Rosamond Boulevard.

At present there is no traffic congestion in the Antelope Valley. Ample parking space is provided at the FRC facilities.

Air

Commercial service to and from the area is available at Palmdale Airport, which is located 38 miles southwest of FRC. Hughes Airwest has daily schedules to Los Angeles originating from the new Palmdale Air Terminal. The City of Palmdale currently has a joint-use agreement with the United States Air Force for use of the property, runways, and taxiways of Air Force Plant 42. This 5800-acre facility has been leased to the City of Los Angeles, which is operating the commercial transport aircraft facility.

In addition, the City of Los Angeles has approved acquisition of an adjacent 18,000-acre parcel for an intercontinental airport. More than 10,500 acres have been purchased, and construction will be started upon acceptance of the environmental impact statement by all regulatory agencies; public hearings have been held on the first draft of the final report, and the results are now being incorporated into the report for submission to the regulatory agencies. This airport is planned to accommodate 50,000,000 passengers annually by 1990.

Population

The Antelope Valley has had a steady growth over the years that is expected to continue and even accelerate with the development of the intercontinental airport at Palmdale. The population in the Antelope Valley was 76,100 in 1970 and is projected to be 96,000 by 1975; 165,000 by 1980; 260,000 by 1985; and 390,000 by 1990.

The population of some towns and communities in the immediate vicinity of FRC are Lancaster, 44,000 (1972 estimate); Palmdale, 12,100 (1973 estimate); Mojave, 4000 (1973 estimate); Rosamond, 3500; and Boron, 2500.

Community Support Facilities

The Lancaster-Palmdale district has 24 elementary and intermediate schools (including parochial), four high schools, and one college. Mojave has two elementary and one high school. The total enrollment of all area schools was approximately 35,000 in 1972.

There are three general hospitals, two in Lancaster and one in Palmdale, with a total bed capacity of 333. Other medical resources include an adequate number of physicians and surgeons, dentists, chiropractors, and optometrists.

Community facilities include churches, libraries, newspapers, radio stations, and banks. Recreational facilities include playgrounds, theaters, country clubs, a public golf course, fishing and hunting clubs, nearby skiing resorts, sand and glider sailing areas, and the campgrounds and wilderness reserves of the 1000-square mile Angeles National Forest.

CODES AND REGULATIONS AFFECTING ENVIRONMENTAL CONTROL

Codes and regulations that affect environmental control of the proposed facilities exist at the federal, state, and local levels. Codes and governing organizations are listed below.

Federal

The National Environmental Policy Act of 1969
The Clean Air Act
The Federal Water Pollution Control Act
The Department of Labor Occupational Safety and Health Administration Standards
The National Fire Protection Association Standards
The Environmental Protection Agency
U.S. Department of Health Education and Welfare
Various standard Air Force manuals, pamphlets, and publications

State

The California Environmental Quality Act of 1970
Industrial Safety Orders, State of California
Construction Safety Orders, State of California
State of California Air Resources Board
The State Industrial Safety Code
The California Regional Board, La Hontan Region

Local

Kern County Building Codes

ENVIRONMENTAL IMPACT ASSESSMENT

DESCRIPTION OF PROPOSED ACTION

ALT and SLS Objectives

The Space Shuttle orbiter is the first vehicle in which the properties of a spacecraft are combined with those of an aircraft. Selection of an ALT and a SLS for the orbiter, prior to vertical flight, are essential for performance assessment and verification of the design for adequate safety and airworthiness. All flight testing for the ALT will be conducted at subsonic speeds.

The test objectives include verification of stability and control, basic aerodynamic values, autoland, ferry performance, and limited subsystem performance. In addition, expertise will be developed in maintenance and operations, vehicle checkout, engineering, and inspection. Achievement of all flight testing objectives is planned to require fewer than 100 hours of flight time during a 14-month period.

Secondary landing site usage for FRC is presently proposed. At least four or five flights will be recovered at the facility. Flight recovery paths are discussed later.

To satisfy the flight test objectives of the ALT and SLS program, facilities needed at FRC will include a suitable hangar, shop space, office space, and automobile parking space. The required facilities reflect a minimum-approach maintenance concept, for it is intended that functional support in meteorology, calibration, photography, etc. (which are normally associated with a flight test program) and in power check pads, engine test cells, fluid storage, open base storage, flight control, and personnel will be provided by NASA FRC or EAFB authorities.

Hangar and Shop Facilities

The hangar must be of adequate size to envelop the orbiter and provide working areas on both sides for personnel and test equipment. The shop space must be adjacent or near to accommodate supporting maintenance, engineering, and testing functions...

The ALT and SLS hangar will be a new building located about 700 feet north of the YF-12, as shown in Figure 9. The nominal hangar dimensions are 175 feet by 140 feet, with a clear height of 61 feet to the lower chord of the roof truss. The interior layout of the hangar will include service units, test stands, jacks, dollies, tow tractors, test equipment, and areas for other ground support equipment (GSE) and for storage. Space is also needed for maneuvering a motor crane around the vehicle.

Main shop facility areas will be provided, as shown in Figure 10, within a lean-to addition, approximately 37 feet by 175 feet, on the north side of the hangar building. The shop operations for which space will be provided include structural repair; wheel, tire, and brake; material review and reclaim; electrical and mechanical building equipment; and GSE maintenance. Other areas associated with shop operations are tool crib, ready storage, and lockers. In addition, space will be provided for toilets, showers, and lunch area.

Other shop areas that require temperature and humidity control will be provided in adjacent trailers easily accessible to the lean-to shop addition. These include electronics and instrumentation, data link, SCAPE (self-contained atmospheric protection ensemble) operations, stockroom, and sampling and analysis.

Mechanical cooling will be provided in all portions of the shop building. An evaporator-type mechanical system will be roof-mounted and cool-air-ducted between the roof and ceiling of the shop area. No air conditioning will be provided in the hangar areas; however, ventilators will be installed to provide for the escape of accumulated warm air from the upper parts of the building.

Heating for the hangar area will be provided by electrically powered space heaters. Strip heating will be used in the low bay areas.

Materials for heating, venting, and air conditioning will be specified to conform to federal specifications wherever applicable. Fire dampers will conform to National Fire Protection Association (NFPA) Standard No. 90A.

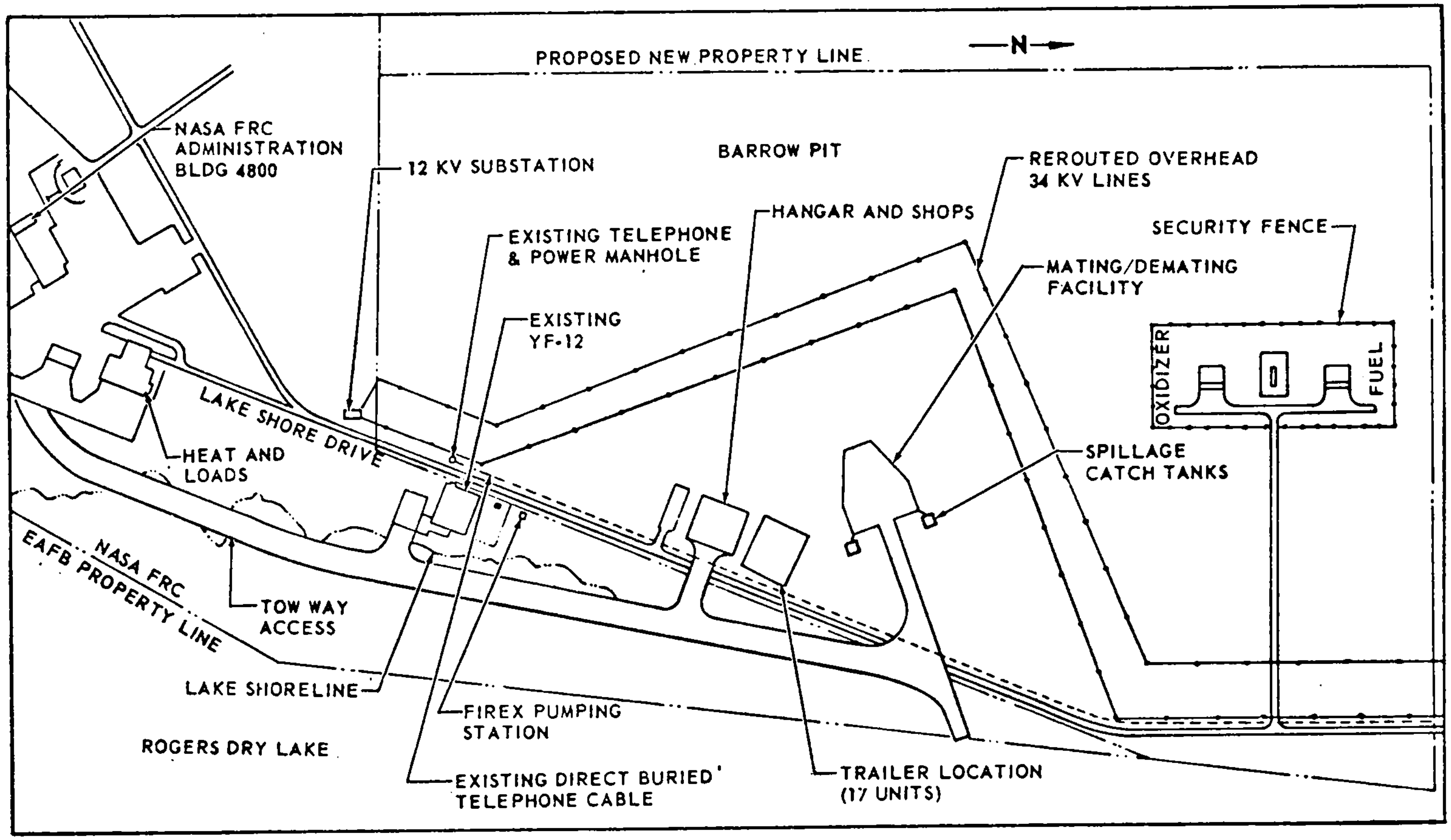


Figure 9. Site Plan-ALT Facility, Flight Research Center, Edward AFB California

Plumbing system fixtures, piping, and drains will conform to federal specifications. Fire protection will be in accordance with NFPA No. 409 for aircraft hangars. The hangar will be provided with a water deluge system in accordance with NFPA No. 16. Shops will be equipped with automatic sprinklers using a wet pipe system. The design will provide a water sprinkler system as described in NFPA No. 16. Two manual alarm stations will be located on each side of the hangar; additional manual stations will be provided in the shop area. Both sprinkler and deluge systems will be connected to the EAFB central alarm system.

All electrical services will be installed in compliance with provisions of NFPA Standard No. 70.

Hangar Functions

The hangar building will accommodate inspection, maintenance, and servicing. Maintenance personnel will perform both scheduled and non-scheduled maintenance, including postflight, preflight, periodic, and special inspections; structural repair; configuration changes; jacking; gear rotation; and instrumentation calibration.

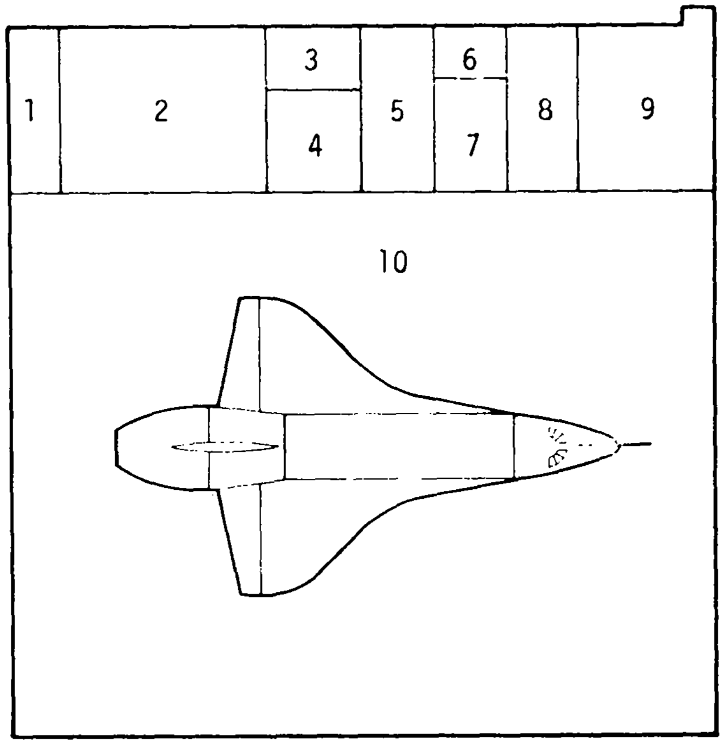
This area will be adjacent to the apron with ready access to tow-ways and maintenance shops.

Shop Functions

Shop facilities are necessary to provide areas for engine and structural repair, GSE maintenance, electronics and instrumentation checkout and repair, and other such ALT and SLS support areas as a tool crib, print files, reliability and quality assurance office, maintenance office, locker, shower and toilet facilities, and lunch rooms. The shop space must be adjacent to or near the hangar to facilitate efficient supporting maintenance, engineering, and testing functions as detailed below.

Structural Repair

This area will contain machinery, sheet metal, tubing, and welding capabilities required for quick-fix repairs as well as on-site engineered repairs requiring special techniques, skills,



1 TOILETS AND SHOWERS

2 STRUCTURAL REPAIR

3 ELECTRICAL EQUIPMENT

4 WHEEL AND BRAKE

5 LUNCHROOM

6 TOOL CRIB } Possibly Combined or Revised

7 TEST OPERATIONS

8 LANDING OPERATIONS

9 GSE MAINTENANCE

10 HIGH BAY ORBITER WORK AREA

Figure 10. Proposed Interior Layout Hangar and Shop Area

and materials. Equipment will include an arbor press, drill press, dual saw, grinder and polisher, work benches, vises, metal cutters, tube benders, and similar tools. Repair work will often require a cut-and-fit technique and will be located as close to the vehicle maintenance area as is practical. Required utilities will include shop air and electrical power.

GSE Maintenance

GSE equipment, both powered and nonpowered, will be maintained in this area. Maintenance will include inspection, repairs, modifications, and calibration. Electrical power will be required.

Electrical and Instrumentation Shop

Vehicle electrical/instrumentation wiring and components peculiar to the orbiter will be fabricated, serviced, and repaired in the electrical shop. Such equipment as wire markers, solder and brazing tools, and ovens for potting and molding will be used. Electrical power will be required.

Wheel and Brake Area

This area will be used for removal, installation, inspection, cleaning, and repacking of wheel bearings. It will also provide short-term storage of built-up shield and brake assemblies. A location adjacent to the hangar is necessary.

Office Facility

The proposed office facility will comprise nine units in five clusters, with provisions for eight more in seven clusters. The basic building block of a massed trailer arrangement is a unit 50 or 60 feet long by 10 or 12 feet wide, manufactured with nominal air-conditioning/heating unit, fluorescent lighting, and required wiring. In addition, existing office space for up to 200 office personnel will be utilized at the north base.

The facilities will be used to house technicians and workers in support of ALT and SLS operations. Layout is as indicated in Figure 11. All offices will be deactivated upon completion of ALT.

Tow-Way and Parking

The project includes approximately 4,300 linear feet of tow-way, which extends in a NNE direction from the existing FRC apron near Building 4823 to the new hangar and mating device pad. The tow-way will be 60 feet wide, constructed of Portland concrete cement, with three feet of asphalt shoulder on each side. In addition, the project includes turnouts to the YF-12 facility, orbiter hangar mating device pad, and lake bed. Total concrete surface is estimated to be 30,000 square yards.

Separate automobile parking facilities for hangar/shop and office personnel will be provided south of the hangar. The automobile parking space required for 100 persons, based on one car per three persons, will be 40 spaces.

Deservicing Area

The OMD will be used for deservicing as well as fueling and vehicle preparation.

Orbiter Mating Device (OMD)

The Orbiter Mating Device (OMD) allows for the orbiter to be hoisted upon and attached to the back of a Boeing 747 ferry aircraft, as shown in Figures 12 and 13. The structure will be located approximately 450 feet northwest of the FRC hangar. The structure will include provisions for servicing the orbiter while on the ground and while on the 747.

It should be recognized that the OMD area will be used for both preparation (fueling, etc.) of the 747/orbiter during the ALT program and the post-flight deservicing and safing of the 747/orbiter combination in the ALT phase or provision of the same functions for the orbiter only in the ALT and SLS programs.

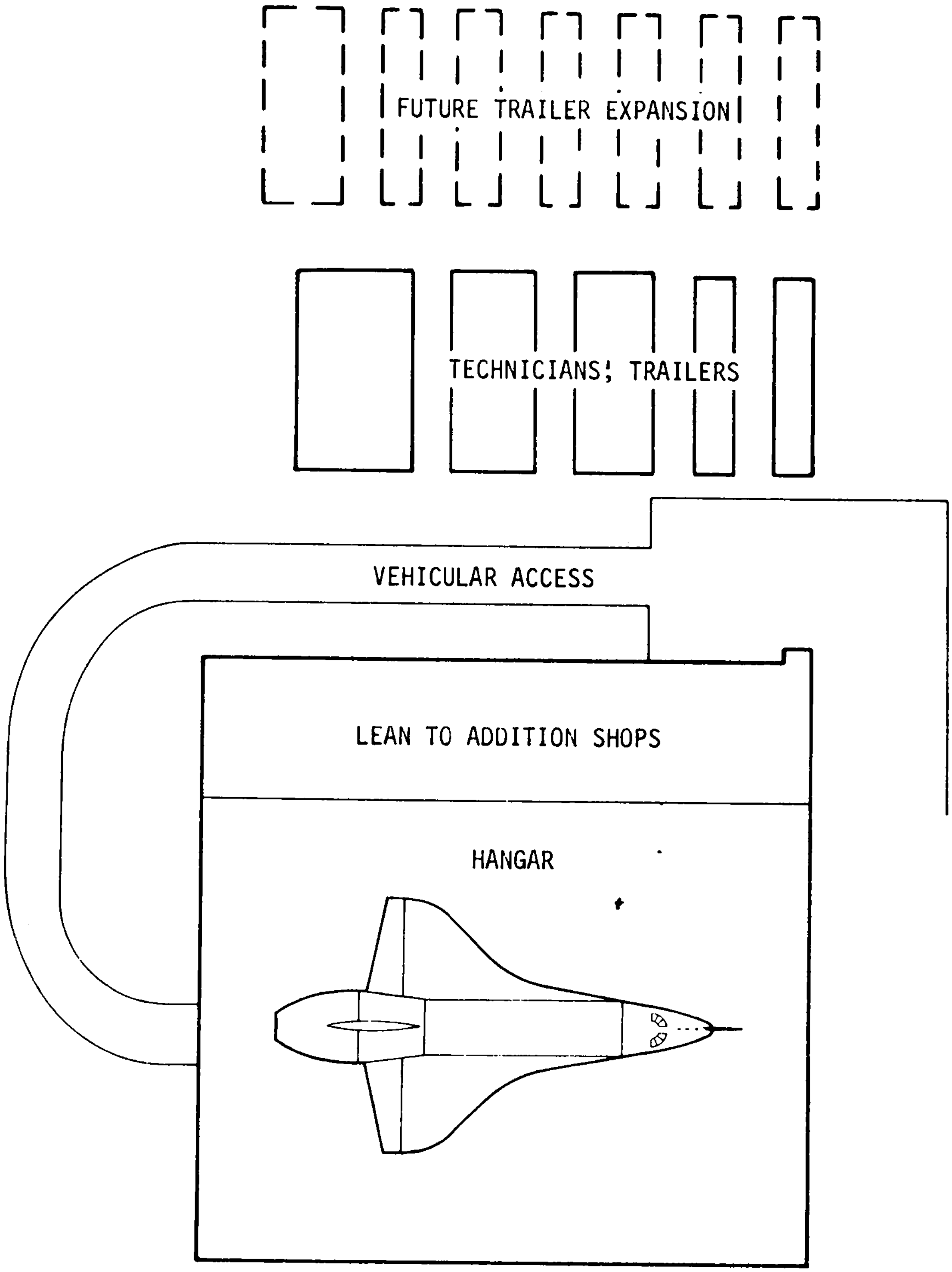


Figure 11. Proposed Layout of Trailer Complex

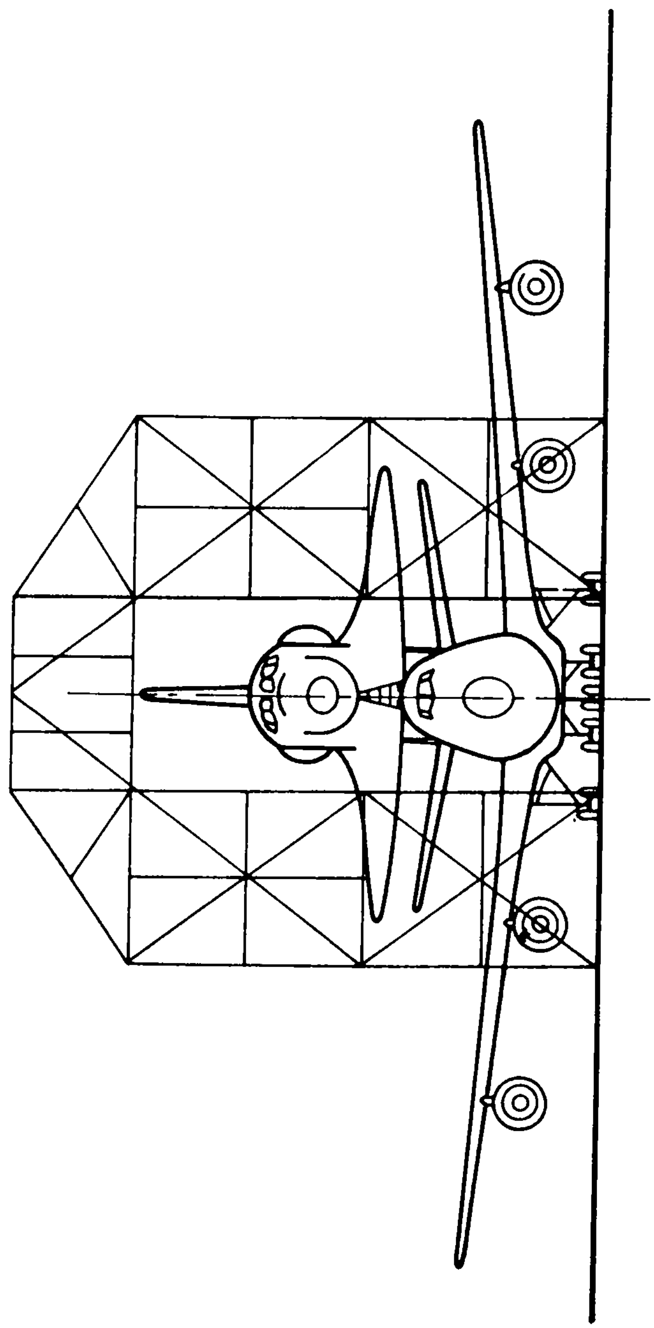


Figure 12. Mating Device

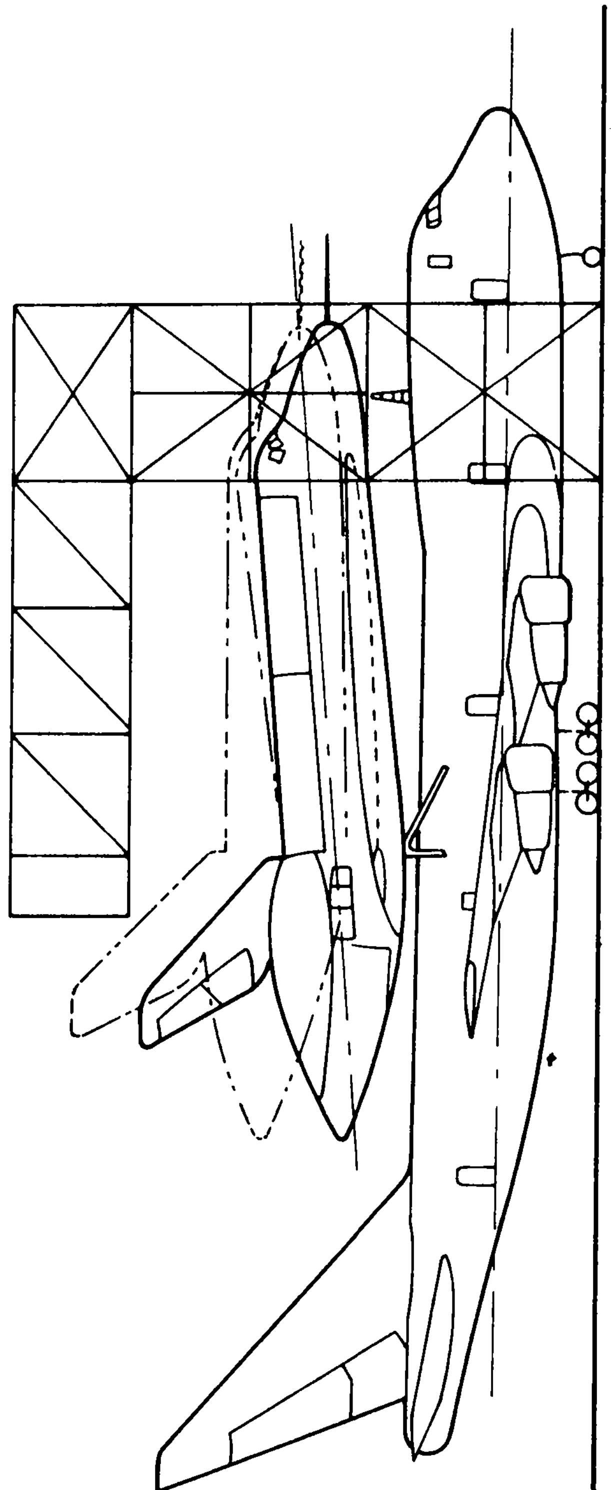


Figure 13. Mating Device

The location of the OMD pad was based upon safety of personnel and the vehicle in case of accidental spillage or rupture of on-board tanks. The pad area is "downwind" (based upon prevailing-wind history) from operational or occupied working areas and SCAPE personnel will be on hand during all servicing or deservicing operations. Vacuum aspirator (suction) equipment will be immediately available to clean up small spills and a pad flushing/perimeter drain system will be used for removal of larger quantities. The diluted effluent from this drain will be directed to storage tanks, where it will be tested, neutralized and treated before disposal. Precautions will be enforced to prevent mixing of fuel and oxidizer effluents in the drainage/holding tank system, thus precluding danger of a conflagration or explosion.

In normal deservicing operations, the fuel/oxidizer tanks will be emptied into mobile or fixed reservoirs and the tanks purged with appropriate solvents. The fuel/purge solvent (probably alcohol) and the oxidizer/purge solvent (probably freon) mixtures will be neutralized and disposed of in a manner meeting all local, state and federal restrictions.

In all phases of operational planning the procedures adopted and precautions taken are intended to insure the safety of crew and operational servicing personnel and the integrity of the vehicle. The detailed procedures for these functions are documented in the KSM-09.1, Ground Operations Planning for ALT and SLS Activities document.

The Orbiter Mating Device rests on a concrete, trapezoidal pad approximately 300 by 250 by 100 feet and 14 inches thick. A collection curb will be installed around the perimeter and discharge into two 13,000-gallon holding tanks through grating covered trenches.

Fuels and Oxidizers

In support of the ALT and SLS operating at the Flight Research Center, the indicated quantities of fuels and oxidizers will be stored in fuel/oxidizer "safe areas' with the storage configuration based on recommended quantity-distance separation specifications.

Storage Area - Approach and Landing Test

Fuel

N_2H_4 -	Sixteen 50-gal. drums 800 gals x 8.4	= 6,720 lb
NH_3 -	Eighteen 150-lb bottles	= 2,700 lb
Alcohol -	500 gals x 6.6	= 3,300 lb
GH_2 -	60,000 scf x 0.00522	= 313 lb
	Total fuel	=13,033 lb

Oxidizer

GO_2 -	100,000 scf x 0.0828	= 8,280 lb

Mating/Demating Area - Approach and Landing Test

(On-Board Orbiter)

Fuel

N_2H_4	864.0 lb
NH_3	900.0 lb
	1,764.0 lb
GO_2	108.0 lb
GH_2	12.8 lb
	120.8 lb

SECONDARY LANDING SITE
MAXIMUM TEMPORARY STORAGE QUANTITIES

The following hazardous fluids, with the exception of alcohol, will be temporarily stored in this facility for only a short period of time. As soon as practical, they will be moved to the designated EAFB disposal area.

Fluid	Total in Pounds
MMH	4,963
N_2O_4	7,939
N_2H_4	585
LO_2	9,372
LH_2	1,114
Alcohol	66,000

The following data details the anticipated quantities, which must be removed and temporarily stored, based upon the analysis of three possible operational modes.

SECONDARY LANDING SITE
(TEMPORARY PRE-DISPOSAL STORAGE IN POUNDS)

SYSTEM	FLUID/NO. OF TANKS	*NORMAL LANDING	EARLY MISSION ** ABORT	WORST CASE ***ABORT
ECS	$GO_2/1$	67 lb	67 lb	67 lb
ECS	$NH_3/2$	51	51	51
FWD RCS	$N_2O_4/1$	193	193	1508
FWD RCS	MMH/1	120	120	943
AFT RCS	$N_2O_4/2$	515	515	1508
AFT RCS	MMH/2	322	322	943
OMS	$N_2O_4/2$	574	574	4923
OMS	MMH/2	358	358	3077
APU	$N_2H_4/3$	283	283	283
PRSD	$LO_2/\overset{+}{2} - \overset{++}{12}$	580	1400	9372
PRSD	$LH_2/\overset{+}{2} - \overset{++}{12}$	65	165	1114
TUG**** (HYPERGOLIC)	N_2O_4	N/A	3775	N/A
TUG**** (HYPERGOLIC)	MMH	N/A	1983	N/A
TUG**** (HYPERGOLIC)	N_2H_4	N/A	302	N/A
TUG (CYRO) ****	LO_2	N/A	2201	N/A

SYSTEM	FLUID/NO. OF TANKS	*NORMAL LANDING	EARLY MISSION ** ABORT	WORST CASE ***ABORT
TUG (CYRO) ****	LH_2	N/A	413	N/A
TUG (CYRO) ****	N_2H_4	N/A	302	N/A

NOTES:

* Nominal residuals for planned mission

** Nominal residuals plus quantities which were not dumped

*** Maximum fluid levels (weight and CG Configuration) the Orbiter is allowed for re-entry and landing

**** Either the hypergolic or cyro tug can be on the Orbiter, not both.

+ 2 tanks for normal landing and early mission abort

++ 12 tanks for worst case abort

Mating/Demating Area - Approach and Landing Test

(On-Board Orbiter)

Fuel	
N_2H_4	864.0 lb
NH3	900.0 lb
	1,764.0 lb
GO_2	108.0 lb
GH_2	12.8 lb
	120.8 lb

Mating/Demating Area - Secondary Landing Site

(On-Board Orbiter, Abort)

NH_3	51.0 lb
MMH	4,963.0 lb
N_2H_4	283.0 lb
N_2O_4	7,939.0 lb
LO_2	9,372.0 lb
LH_2	1,114.0 lb
	23,722.0 lb

Mating/Demating Area - Secondary Landing Site

(Payload - Hypergolic Tug)

MMH	1,983.0 lb
N_2O_4	3,775.0 lb
N_2H_4	302.0 lb
	6,060.0 lb

For assessment of the environmental impact of an accident spill of hazardous materials in an area without spill controls, e.g., catchment tanks and water deluge systems, it can be assumed that if fuels and oxidizers mixed a fire would result and the fuels (hydrogen, hydrazine, and (MMH) monomethylhydrazine) would be consumed. It must be noted, however, that the handling of fuels and oxidizers will be in accordance with procedures established during the other successful man-rated programs, which have not resulted in spills in any amount to incur environmental damage.

A threshold limit value (TLV) for MMH has been established at 0.2 ppm. This is somewhat less than the TLV for hydrazine, which has been set at 1 ppm for an 8-hour exposure of an industrial worker. The accidental dumping of the entire quantity of MMH in an unprotected area would expose the environment to high concentrations of MMH vapors. The release of 350 gallons of MMH would violate the threshold limit values in an area with a radius of 500 yards. The vapor could, as in past spills, hover close to the ground and expose the biota in the immediate vicinity (100 meters) to concentrations of vapors in excess of 1000 ppm. The effect would be denuding the immediate area.

The safety procedures established in previous programs will be used at FRC and are expected to prevent or minimize the effects of such accidents by use of rigid processing and handling procedures. The accidental spill of a full load of propellant is considered very unlikely, and the environmental effects of such a spill would be detrimental to only an extremely small portion of the desert. Personnel exposed to the hazards are trained and equipped to prevent and contain spills wherever they occur.

Orbital Maneuvering Subsystem

The Orbital maneuvering subsystem (OMS) provides the propulsive thrust for the final increment of velocity necessary for orbit insertion, orbit circularization, orbit transfer, rendezvous, and deorbit.

The propellant quantity required for the design mission is provided in two removable pods located on each side of the aft fuselage. Provisions for additional tankage are available in the payload bay area. The additional tankage is referred to as the payload bay kit (PBK).

Each OMS pod contains a bipropellant engine utilizing pressure-fed hypergolic monomethylhydrazine (MMH) and nitrogen tetroxide (N_2O_4) at a mixture ratio of 1.65. The combustion product gas composition of the OMS for nominal operating conditions is approximately as follows:

Product	Percent by Wt
H_2O	30
N_2	42
H_2	2
CO	16
CO_2	10

The intent of the system design is for the operation to be fail safe (FS). Redundant pressurant flow paths and propellant valves are provided in each pod. The propellant in both pods is necessary to fulfill all mission requirements. According to present plans, the OMS system will not be tested during any portion of the ALT or SLS programs at FRC. It is included in this assessment only because of the fuel/oxidizer disposal responsibilities it places on FRC in the SLS program.

APU (Auxiliary Power Unit)

The auxiliary power unit (APU) consists essentially of a turbine, a catalytic gas generator, a fuel pump, an APU controller, speed control and fuel shut-off valves, appropriate instrumentation and safeties, and a thermal control system.

The APU converts chemical energy stored in the liquid hydrazine fuel into mechanical shaft power for operation of the orbiter hydraulic pumps. The hydrazine is rapidly vaporized in the gas generator, and the principal decomposition products in the exhaust consist approximately of eight percent hydrogen, 28 percent ammonia, and 64 percent nitrogen.

The normal fuel capacity is about 283 pounds, of which approximately 195 pounds are consumed in a combined run of 90 minutes at idling and 40 minutes at design speed.

RCS (Reaction Control Subsystem)

The forward and aft modules of the reaction control subsystem (RCS), operating in conjunction with guidance, navigation, and control, employ 24 bipropellant primary thrusters and 4 vernier thrusters to provide precise attitude control and three-axis translation during separation from the external tank, orbit insertion and orbital and entry phases of flight. In addition, backup capability for OMS propellant acquisition or for roll control during OMS single-engine operation is provided.

The RCS propellants are nitrogen tetroxide (N_2O_4) and monomethylhydrazine (MMH). The specific exhaust products and corresponding mass fractions from a bipropellant engine are a function of the propellant combination, mixture rates, and exit expansion rates. An approximation of the composition and proportions of the principal components of the RCS engine exhausts is:

Constituent	Percent
N_2	41
H_2O	33
CO_2	14
CO	11
H_2	1

The pulse mode operation of the bipropellant engines yields intermediate compounds in addition to the nominal exhaust constituents during start-up and shut-down sequences, when mixture ratio excursions occur.

The pulse mode of operation during the previous design development of the Apollo RCS thrusters yielded an intermediate compound, monomethyl-hydrazine nitrate. Small quantities of this sticky, viscous liquid would collect around the thruster nozzle while tests were being conducted. The compound caused some concern because it would, infrequently, detonate inside the engine. Since the MMH nitrate could detonate and possibly damage the thrusters, an injector heater was added to evaporate the liquid and the thrust chamber was strengthened to withstand additional overpressure.

The final design and testing of the Orbiter RCS thrusters is not yet complete. The problem of MMH nitrate detonation is being addressed and the present RCS thruster development program is geared to alleviate the formation of this secondary compound and minimize the possibility of detonation. The possibility does exist, however, and the future RCS thruster design would incorporate features, resulting from an extensive development/testing program, that would enable the safe operation and servicing of the Orbiter during all phases of the Shuttle Program.

PROBABLE IMPACT OF PROPOSED ACTION ON THE ENVIRONMENT

Effect on Land Form

A minimum of grading will be required for the hangar, apron, tow-way, runway, roads, and parking, since the site is practically level. Thus, there will be little or no change in land form.

Effect on Atmosphere

Principal atmospheric contaminants will include dust raised during construction, emissions from construction equipment, engine exhaust gases from APU run-up and ALT, and exhaust from the automobile traffic generated during construction and operation of the facility. Construction will be temporary, and the resulting atmospheric pollution very slight. Engine run-ups and flight testing of the orbiter will have an actual duration of approximately 1000 hours over a period of approximately 14 months; the exhaust gases from these operations will form a small percentage of the pollution resulting from other operations in the area, and small-scale accidental spills of hazardous materials will be quickly dissipated into the atmosphere.

Automobile emissions during construction and operation will be produced by 100 automobiles or fewer over a period of about three years. The resulting atmospheric pollution in the Antelope Valley will be negligible.

Effect on Biota

Since the flora and fauna in the vicinity of the proposed site are typical of a desert environment, they are hardy and sparse. The building site is presently being used for equipment storage and is quite bare; therefore, the minimal air pollution produced by construction and operation of the facility will have no effect on the plant and animal life.

Approximately seven acres of desert flora will be cleared for the proposed operations. This long-term effect will be considered later.

Effect on Geology, Seismology, and Subsidence

The detrimental geological features nearest to the proposed site are the Garlock and San Andreas fault zones. The hangar will be designed to withstand a large-magnitude (7.5 to 8) earthquake, whose epicenter is along the Garlock or the San Andreas faults, without significant permanent structural damage. Such a design will preclude catastrophic earthquake results. Moreover, the facility itself will not affect the subsidence of the area.

Effect on Drainage

The storm runoff from the proposed site area will increase as a result of the increase in covered and paved areas. However, since these areas are small and will drain directly into the lake, the existing drainage system will not be affected by the small increase in runoff.

Effect on Water Supply and Quality

Water of good quality (total dissolved solids' content 520 parts per million) is supplied by EAFB from wells with a capacity of 9 million gallons per day (mgd). These wells tap aquifers which range in depth from approximately 150 to 550 feet. Apart from chlorination, no treatment is necessary for the potable water. The present average domestic and industrial water use is 4.8 mgd. Since no proposed orbiter operation will require an excessive quantity of water, the increased water demand due to 300 persons on the proposed project will be 0.03 mgd, which is negligible. Therefore, the supply will be ample for the domestic as well as the fire demand.

Effect on Sewage Flow and Treatment

Domestic sewage from EAFB, including NASA FRC, is collected and subjected to primary and secondary (oxidation pond) treatment in the Air Force sewage treatment plant, which conforms to Air Force Regulation 91-9, Manuals 85-13 and 88-10. The sludge is disposed of in the sanitary land fill, and the effluent from the oxidation ponds is disposed of by evaporation. Thus, no pollution is caused by the sewage. The sewage treatment facilities have a capacity of more than 1.5 mgd, and the actual flow averages 1.0 mgd. The additional orbiter project sewage flow of 0.02 mgd can be easily assimilated.

Effect on Other Utilities

The existing gas and electric supplies can easily satisfy all requirements of the proposed project. There will be no adverse impact upon reserves of gas and electricity. Telephone service will not tax the existing capability in the area.

Effect on Acoustics

The acoustic levels on the site are occasionally high because of aircraft operations at NASA FRC and EAFB. Orbiter ALT operations entailing engine run-up with concomitant high sound-pressure levels of 100-120 dBA will not be novel to the area.

These operations will be limited to a period of approximately 14 months; thus, the increased noise pollution will be intermittent and temporary. Moreover, personnel in the immediate area will be protected from noise during APU run-up by protective headgear. The APU's will be tested under partial load at the Orbiter Mating Device pad to insure operation of all mating interface systems and other functions dependent upon power from the APU. After testing, the APU will be shut down and not operated during towing or taxiing along contractor row. Upon arrival at the main Edwards Air Force Base runway, the APU's will be activated and checked at full output. This is scheduled for completion at the time - takeoff minus 8 minutes.

ENVIRONMENTAL EFFECTS FROM THE SHUTTLE

Effects of Sonic Boom

The final resultant of sonic boom studies, currently underway, will be appended to this assessment as soon as available. The results should be more complete and factual than presently documented predictions.

Effect on Land Use

Land use will be changed not only at FRC, but also in the neighboring communities. An expected increase of 400 to 600 new families would create a need for residential and commercial land use. Since the local area is expected to grow rapidly, the change is congruent with established zoning and master plans.

Effect on Transportation and Traffic

Approximately 4600 EAFB and NASA FRC employees live off base and generate automobile traffic. An additional 300 employees could cause a 6.5-percent increase in traffic. It is expected that the existing highway system could absorb this increase without congestion.

Effect on Population

The increase in the population of the neighboring communities resulting from the proposed project will be minimal and can be readily integrated. The population of the Antelope Valley is expected to more than double during the present decade. Therefore, a population increase in this area has already been anticipated and will become part of the planned development of the Antelope Valley. The addition of 300 primary employees should create an anticipated population increase of 1200 to 1500 persons in the Antelope Valley.

Effect on Community Support Facilities

Community support facilities, such as schools and recreation areas, will be affected slightly by the increase in population, but present recreation areas are not crowded and the expected impact will be insignificant. The greatest impact would be experienced in the schools, which are fairly full at present; however, new schools are being built to relieve the pressure and accommodate new students. Ample space is available for expanding these facilities.

Effect on Economy

The economy of the Antelope Valley will be directly benefited by the addition of economic base employees. Approximately 200 secondary employment jobs would be created. At the completion of the project the economic impact would be slight and of short duration. The area's economy is growing rapidly due to the location of other industries and is expected to rise dramatically when the new intercontinental airport is completed. A short-term setback would be expected to have no adverse effect on the local economy.

Effect on Aesthetics

Within the FRC proposed ALT and SLS facility, the aesthetic change would be removal of an existing storage area and the addition of two large structures and one mile of tow-way. No changes are proposed which would alter the existing aesthetic quality of the entire complex.

PROBABLE ADVERSE ENVIRONMENTAL EFFECTS

The proposed action will have minimal impact in all environmental areas. Probable impacts will be as follows:

An imperceptible change in land form.

An insignificant increase in the use of domestic and industrial water.

A small increase in sewage flow and treatment, which will have no effect on ground water quality.

Some intermittent increase in the atmospheric pollution for a limited period.

A slight increase in the use of utilities and community support facilities.

Use of a small area of open space land for industrial building.

Development of some annoyance but no physiological harm or physical damage due to sonic boom effects during Shuttle landing operations.

ALTERNATIVES TO THE PROPOSED ACTION

The EAFB site was selected for the ALT Program over two other sites, KSC and Eglin AFB. Ninety-four sites were considered for flight testing. A number of those were included solely because of their potential dual usage for both flight testing and launch operations. These, however, were eliminated as a result of operation site studies. Essential considerations regarding selection of the ALT and SLS site included program safety, proximity of alternative landing sites, prevailing weather conditions, impact of flight operations on populated areas, and implementation costs.

Eglin AFB was considered when the final assembly point would have been in Tulsa, Oklahoma, or Michoud, Louisiana. The completed orbiter would be transported by barge to Eglin AFB, as no accessible airfield exists at Michoud. With Tulsa as the final assembly site, the completed orbiter could be ferried to Eglin AFB. Eglin would require modifications to the King Hangar or use of the Climatic Hangar for refurbishment, maintenance, and repairs requiring full vehicle weather protection.

It would be necessary to provide a safing area at a remote location adjacent to the main runway, and access to the gulf and docking facilities would be required. Most testing operations would require additional augmentation by providing additional facilities.

Selection of KSC for launch operations would make it a logical site for flight testing. Existing facilities would require minor modification for the approach and land tests. Weight and balance facilities would be needed in addition to an engine/thrust calibration facility. KSC would permit single organizational responsibility for flight test and operations, allow for efficient use of functions, and avoid implementation of a separate flight test facility or extensive rehabilitation of an existing facility.

Use of the NASA Flight Research Center at Edwards AFB for flight testing would require minor modifications to meet Shuttle facilities criteria. The primary modification would be the addition of a hangar and safing area. Edwards offers the highest degree of product and personnel safety because of the extensive alternative dry lake landing sites. The weather is satisfactory 99 percent of the days with thunderstorms and lightning occurring 0.1 percent of the time hourly.

ALT could have been accomplished at any of the three sites. After Palmdale was selected as the final assembly point, Edwards became the prime site for the ALT and SLS operations, not only because of proximity to the final assembly point, but also because of the high degree of safety afforded the product, personnel, and the surrounding environment.

As an additional alternative, no action on the proposal at FRC would result in the exclusion of a site that would have the least irreversible environmental impact.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM AND LONG-TERM EFFECTS

Local short-term effects will include some disruption of community life by construction workers in the area and later by the additional employees needed to operate the facilities. These persons would soon be assimilated into the neighboring communities, which are expecting a rapid population growth in the Antelope Valley during this decade.

Long-term effects will include an increase in the economy of the area while the balanced communities grow in an orderly manner, which conforms with the master plans of the area. Long-term effects must consider the advantages to be gained from the Space Shuttle Program itself; weather prediction, observing astronomical phenomena heretofore unseen, repair of malfunctioning satellites, and the many other technological advancements that issue from space travel. Moreover, the concept of a reusable reentry vehicle is to allocate our materials in a manner to promote wiser uses of earth's resources.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES FROM THE PROPOSED ACTION

The irreversible and irretrievable commitments of resources from the proposed action will include the construction materials necessary to build the hangar, the gas and electricity needed to operate the facility, the fuel needed to test the orbiter, and the land to be used for the hangar building, tow-ways, roads and parking lots. However, apart from the energy used in construction and in testing, the resources may not be considered totally irretrievable, as the buildings and other facilities may be modified and adapted to other purposes at the end of this program. Where necessary, buildings may be removed and the land reused.

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